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               PREDICTING FLEET PERFORMANCE OF U.S. NAVY PARAMEDICAL PERSONNEL--ETC(U)
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PREDICTING FLEET PERFORMANCE OF U.S. NAVY

PARAMEDICAL PERSONNEL

J. M. GOFFMAN

REPORT NO. 74-64

NAVAL HEALTH RESEARCH CENTER

SAN DIEGO, CALIFORNIA 92152

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND

BETHESDA, MARYLAND

Predicting Fleet Performance of

U.S. Navy Paramedical Personnel*

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Abstract

The utility of numerous cognitive and demographic measures as predictors of an on-the-job performance criterion for paramedical personnel serving in the U.S. Navy was investigated. Subjects were 1,315 graduates of Hospital Corps School, San Diego, California, who had completed their initial tours of duty as Hospitalmen. A composite score which measured on-the-job effectiveness as a function of recommendations by supervisors as well as premature separations from the service represented the criterion measure. Twenty-three cognitive and demographic items were analyzed using multiple regression techniques to obtain weights for predicting performance in a cross-validation sample. Findings indicated that non-cognitive measures added uniquely to prediction of on-the-job performance.

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Predicting Fleet Performance of

U.S. Navy Paramedical Personnel*

The policy of an all volunteer military force has resulted in critical shortages of professional medical care personnel in the U.S. Navy. This shortage has required the naval service to place added responsibility upon paramedical personnel to supply these vitally needed health care services. Unfortunately, however, attrition rates for paramedical personnel have been consistently high over the years during training, 10-12% annually, and subsequent to training in the fleet, approximately 18%. The need to reduce attrition in this critical rate has prompted the U.S. Navy to initiate an extensive program of investigation involving procedures to select, train, and utilize paramedical personnel. This paper, the first of a series, is concerned with developing more efficient procedures of selecting paramedical personnel.

The use of cognitive measures as predictors of performance has been extensive throughout the military service (Lecznar & Davydiuk, 1960; Helme, 1965; Swanson & Rimland, 1958). Such studies were primarily directed toward relating cognitive measures to Grade Point Average (GPA) as a criterion of success in Hospital Corps School. In addition, a few studies have been reported showing a significant contribution of non-cognitive data to the prediction of academic performance for medical specialists (Brokaw, 1962; Chen &

Wood, 1963). In these studies biographical and demographic data discriminated between groups of individuals passing and failing Corps School training programs.

Presently, the Navy Service School selection program is an outgrowth of validation studies conducted by Alf, Gordon, Rimland and Swanson (1962). These investigators validated the Basic Test Battery (BTB) as a predictor of GPA at service school graduation. Revisions of the BTB validation studies established the present requirements for admission to Hospital Corps School (Thomas, 1969; Thomas, 1972). The results of these studies indicated that valid prediction of academic success can be obtained when using a combination of cognitive measures, namely, the General Classification Test (GCT) plus the Arithmetic Test Score (ARI).

It is only recently that evidence has been presented to indicate the deficiencies in the present selection procedures. In an unpublished proposal, Plag (1967) alludes to high rates of non-effectiveness for certain occupational groups and suggests the need for comprehensive studies which will produce information to be utilized in classification and assignment decisions in order to reduce non-effectiveness of high-cost personnel.

The utility of an on-the-job performance criterion for the selection of military personnel was addressed by Plag and Goffman (1966, 1968). Their extensive studies relating cognitive, non-cognitive, and demographic predictors to a criterion of effective service during initial tours of duty, demonstrated the validity of these procedures as selection methods for naval enlisted personnel. In a follow-up study Plag, Goffman, and Murphy (1969) compared medical

specialists with other occupational groups as well as sailors serving in gen-
eral duty billets with respect to effectiveness rates. Their findings showed
that medical specialists had an 18.7% non-effectiveness rate subsequent to
Corps School graduation which was significantly higher than that of other
groups. This poor performance was attributable to medical (primarily psychi-
atric) and administrative separations. Despite the fact that these studies
were an outgrowth of psychiatric screening methods, the procedures were
expanded to identify administrative as well as psychiatric casualties in the
U.S. Navy.

Although previous research has attempted to discover valid predictors of
service school adjustment, no attempts have been aimed specifically at predic-
ting performance in the fleet subsequent to service school graduation. The
purpose of the present study was to assess the predictive validity of certain
pre-service measures for the selection of medical specialists in the U.S. Navy
by investigating the practical utility of cognitive and non-cognitive measures
as predictors of on-the-job performance in the fleet for Hospital Corpsmen.

PROCEDURE

Subjects

Subjects were 1,315 students who entered Hospital Corps School, San Diego,
California, between November, 1966, and August, 1967, and graduated success-
fully from the Corps School training program. The mean age for the validation
group was 19.2 years. For the purposes of analysis, the graduates were divided
into two groups: the first group of 658 graduates was designated the validation
sample, and a second group of 657 graduates was designated the cross-validation

sample.

Criterion of Effectiveness Score

At the time of discharge from the service each subject was assigned a score of one or zero to indicate a composite representing service performance. This composite was based upon type of discharge, conditions of discharge, and whether the subject performed effectively or ineffectively during his initial tour of duty as rated by his immediate superior at the time of discharge. Specifically, Corpsmen discharged prematurely from their obligated tour of duty by reason of unsuitability, misconduct, unfitness or punitive action were considered non-effective and assigned an effectiveness criterion score of zero. Subjects discharged for reasons pertaining to convenience of the government or expiration of enlistment who were not recommended for reenlistment were also considered non-effective as were Corpsmen discharged because of physical disability for psychiatric causes or for illnesses existing prior to entry into the service. On the other hand, Corpsmen who completed their tours of active obligated service and were recommended for reenlistment were considered effective and were assigned a criterion score of one. Corpsmen who died while in service or who suffered service incurred disabilities were not included in this study.

Measures

All predictors used in this study were obtained from documents which were administered prior to the subject's entry into Hospital Corps School. Two types of variables included were: cognitive measures and demographic data.

Cognitive measures consisted of subtest scores from the Basic Test Battery (BTB) which was administered to incoming recruits during basic training approximately two days after arrival. The subtests consisted of measures of verbal, arithmetic, clerical and mechanical ability. The second set of predictors consisted of demographic data obtained from a questionnaire which was routinely administered to each naval recruit subsequent to taking the Basic Test Battery. This form, administered in the afternoon of the second day of training, was titled Medical Screening Form Personal Information and included such items as age at time of recruit training (AGE RT), marital status (MARSTAT), whether the subject had ever had a nervous breakdown (BREAKDOWN), and whether suicide had ever been attempted (SUICIDE).

Analyses

The analysis was conducted in three major stages. The first two stages applied to the validation sample only. The first stage employed a technique to linearize all variables which were curvilinearly related to the criterion. The technique proceeded as follows: The first step was to segment the predictor variables and calculate the criterion mean for each segment. Continuous variables were divided into equal interval segments. The next step involved testing the criterion means of adjacent segments. Those segments which had less than three subjects were immediately combined with the next highest adjacent segment. Segments which were not significantly different from one another at the .10 level of significance were combined. However, before this could be done for discrete variables, it was necessary to rank-order the segments on the basis of their criterion means. This second step

continued until all adjacent segments were significantly different, at which time the linearization of the variable was complete. At this point the predictor segments were assigned the values of the criterion means for use in the succeeding stages of analysis.

The second stage was to obtain the correlation of the linearized variables with the criterion. All variables which were not significantly related to the criterion ($p < .05$) were eliminated from subsequent analyses.

The third stage consisted of developing a regression equation which would best predict the effectiveness criterion. The validation sample and the cross-validation sample were both processed in this stage. In addition, other equations were derived to compare the findings of this study to presently used selection procedures. First, an equation was derived with the variables presently used for the selection of Hospitalmen (GCT + ARI). Secondly, an equation was derived using all cognitive variables available in order to maximize predictive validity. Next, demographic variables were introduced with the cognitive variables to ascertain their unique contribution to prediction.

RESULTS

The sample yielded an overall rate of effective performance of 77.87%. For those 291 subjects declared non-effective, the largest group, 248 subjects, were prematurely separated from service. The criterion means for the validation sample and cross-validation sample were comparable, .778 and .779, respectively. Analysis of the composition of the two groups with respect to demographic variables such as age and education level completed prior to service entry indicated no significant differences between groups.

Table 1 presents the product-moment correlation coefficients for the significant cognitive and demographic variables related to effectiveness and used in the subsequent regression analyses. The Table indicated the most valid predictors of effectiveness to be, in order of importance (highest to lowest validities), GCT, EDUC, MECH, ARI, and EXPUL.

(Insert Table 1 about here.)

Regression Analysis

The following descriptions are based upon the distribution of scores in the validation sample for those variables most highly related to the on-the-job effectiveness criterion. The values in parentheses are the criterion mean values assigned segments of each variable to linearize the predictor-criterion relationships.

General Classification Test (GCT)

The GCT scores ranged from 36 to 75. Approximately 11% of the subjects had GCT scores less than 50. Thirty-nine percent had scores between 50 and 59, 40% between 60 and 64, while only 8% had scores higher than 69. The average GCT score for the group was 59.07, almost one standard deviation above that of the average sailor. (GCT score 49 or less = .595; 50 to 59 = .758; 60 or greater = .834)

Education (EDUC)

The years of school completed ranged from 10 to 16 years. Approximately 98% of the sample were high school graduates. Five percent were graduated from college. Forty-nine percent had not gone beyond the high school level. The mean number of years completed was 12.90. (Education completed 13 years or less =

.740; 14 years = .855; 15 or more years = .949)

Expulsions (EXPUL)

Eighty-seven percent of the subjects had never been expelled
or suspended from school. Nine percent had been expelled
once, while 4.3% had been expelled more than once. (No
expulsions or suspensions = .804; one or more expulsions
or suspensions = .607)

Mechanical (MECH)

The MECH scores ranged from 31 to 69. Thirty-eight per-
cent of the sample had MECH scores less than 50. Forty-
four percent had scores between 50 and 59, while 17% had
scores higher than 59. The average MECH score was 51.84.
(MECH scores 44 or less = .613; scores 45 or greater = .807)

Missed School Due to Nervousness (NERVES)

This item was a dichotomous question with the responses
being yes or no; 8.5% responded affirmatively to this
question. (Yes = 1.0; No = 0.0)

The first regression analysis involved deriving an equation using all the
significant cognitive variables. The regression weights used in the equation,
along with its cross-validity coefficient, are shown in Table 2. The validi-
ties reported were obtained from the cross-validation sample. The validity
for this equation of .180 when compared to the presently used selection
equation, namely GCT + ARI, of .162 was not significantly larger. However, in
the second analysis when demographic variables were added to cognitive variables

an appreciable increase in validity was achieved. In this case the cross-validity of .180 for cognitive variables alone was increased to .249 (t = 2.327, p < .05). The increase in validity was most significant when compared to the present selection equation (t = 2.432, p < .01).

DISCUSSION

The results of this study indicated the utility of cognitive and demographic variables as unique predictors of successful performance for Hospital Corpsmen. Although new cognitive data by themselves did not add to predictive validity over established methods, a combination of cognitive and demographic variables did significantly enhance predictability. Applying the current methods of selection to the sample used in this study, namely GCT + ARI, resulted in a validity coefficient of .162. However, if the multiple composite derived from this study were to be used, namely MECH, EDUC, NERVES, EXPUL and GCT with a validity of .249, significant improvement in prediction would be obtained.

It is important to note that a large portion of the increase in predictive validity is attributable to the variables which measure the applicant's prior school success. The variables found most valid for predicting on-the-job performance were GCT and EDUC, and GCT had the highest correlation with effectiveness. The GCT variable was of such importance that it alone accounted for about 51% of the variance attributable to the combination of five significant predictors. The multiple regression analyses results provide evidence consistent with other studies which predict on-the-job success; it appears that a Hospital Corpsman's success in the military service is highly related to his

ability to complete his formative school experiences.

The utility of the derived equation can best be appreciated by considering the following example. A prospective applicant has the following characteristics: a MECH score of 58 (value = .807), completion of 12 years of school (value = .757), no missed school as a result of NERVES (value = 0.0), one EXPULsion from school (value = .607), a GCT score of 58 (value = .758). Hence, using these values in the regression equation:

$$.824 (.807) + .650 (.757) - .150 (0.0) + .837 (.607) + .678 (.758) -$$
$$1.530 = .649.$$

The obtained predicted effectiveness score is .649. This score can be interpreted as representing 65 chances in 100 of providing effective service performance during an initial tour of active duty.

In conclusion, it should be pointed out that the equation derived in this study is intended merely as a first step in developing guidelines for the counseling and selection of prospective students for Hospitalman ratings. At this stage scores should be interpreted only as rough estimates of the probability of successful performance and much remains to be done. Other studies must emphasize the use of controls other than demographic elements such as age and education. For example, a study should be initiated to evaluate the influence of training sequence. Whether a man goes to school immediately after basic training or six months after serving in the fleet might act to modify attrition rates. This factor, in addition to criterion refinement and evaluation of personality dimensions, should be investigated in further studies.

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Footnote

*Report No. 74-64, supported by the Bureau of Medicine and Surgery, Department of the Navy, under Research Work Unit MF12.524.002-9002. Opinions expressed are those of the author and are not to be construed as necessarily reflecting the official view or endorsement of the Department of the Navy.

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Table 1

Cognitive and Demographic Predictors of Effectiveness

	r	Item
Section A		
	.178**	GCT
	.164**	ARI
BTB Data (Cognitive)	.167**	MECH
	.085*	CLER
Section B		
	.119**	AGE RT
	.075*	MARSTAT
	.176**	EDUC
Medical Screening Form Data (Demographic)	-.103*	BREAKDOWN
	-.103*	NERVES
	-.123**	SUICIDE
	.163**	EXPUL

* $p < .05$

** $p < .01$

Table 2

Predictors and Regression Weights of
Hospital Corpsmen Effectiveness

Procedure	Predictor Variable	Cross-Validity R	Regression Coefficient
I. Present Selection Procedures	GCT + ARI	.162	
II. BTB Variables Only	MECH		.85021
	GCT		.88204
	Constant (K)	.180	-.56756
III. BTB plus Medical Screening Form Items	MECH		.82394
	EDUC		.64959
	NERVES	.249	-.14988
	EXPUL		.83697
	GCT		.67771
	(K)		-1.53046

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4. TITLE (and Subtitle) Predicting Fleet Performance of U.S. Navy Paramedical Personnel		5. TYPE OF REPORT & PERIOD COVERED Interim rept.
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jerry M. Goffman	M4305	8. CONTRACT OR GRANT NUMBER(s) M4305.08-3014
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Health Research Center San Diego, California 92152		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Medical Research and Development Command Bethesda, Maryland 20014		12. REPORT DATE September 1974
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Bureau of Medicine and Surgery Department of the Navy Washington, D.C. 20372		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Paramedical selection
Selection
On-the-job performance
Navy Hospitalmen

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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S/N 0102-014-6601

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